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*****
;
; PROGRAM ID:      BOOTSTRAP INJECTION MODULE
;
; *****
;
; PROPERTY OF:     JADE COMPUTER PRODUCTS
;                  4901 W. ROSECRAWS BLVD.
;                  HAWTHORNE, CALIFORNIA
;                  90250, U.S.A.
;
; *****
;
; VERSION:         2.2
;
; *****
; THE BOOTSTRAP INJECTION MODULE IS ONE OF TWO
; MODULES THAT TOGETHER MAKE UP THE SYSTEM RESIDENT
; BOOT. THIS MODULE IS DOWNLOADED INTO THE DOUBLE D
; MEMORY BY THE SYSTEM BOOTSTRAP DRIVER. THE MODULE
; THEN READS IN THE DISK CONTROLLER MODULE (DCM) FROM
; TRACK 0. THE ORIGIN OF THIS PROGRAM IS FIXED AS IT
; IS ASSEMBLED TO EXECUTE INSIDE THE DOUBLE D. THE
; BOOT INJECTION MODULE CAN THEREFORE RESIDE IN
; THE BOOTSTRAP PROM WITHOUT THE NEED TO REASSEMBLE.
; NOTE: STEP TIMING AND MOTOR TURN-ON DELAYS ARE
; DEFINED IN THIS MODULE. PATCHING MAY BE REQUIRED.
; ***** SK *****
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; *****
; CONTROLLER PORT ASSIGNMENTS
; *****

0000      BL.STS ==      000H      ;BOARD STATUS
0000      BL.CTL ==      000H      ;BOARD CONTROLS
0004      WD.CMD ==      004H      ;1791 COMMAND REGISTER
0004      WD.STS ==      004H      ;1791 STATUS REGISTER
0005      WD.TRK ==      005H      ;1791 TRACK REGISTER
0006      WD.SEC ==      006H      ;1791 SECTOR REGISTER
0007      WD.DTA ==      007H      ;1791 DATA REGISTER
0008      XP.STP ==      008H      ;STEPPER PULSE
0010      XP.MTO ==      010H      ;MOTOR TIME OUT
0040      XP.MTX ==      040H      ;MOTOR TIME EXTEND
0080      XP.DSH ==      080H      ;DATA SYNC HOLD

; *****
; 1791-01 COMMAND CODES
; *****

0018      DC.HDL ==      018H      ;LOAD R/W HEAD.
0090      DC.RMS ==      090H      ;READ MULTI-SECTOR.
00D0      DC.STS ==      0D0H      ;SET TYPE 1 STATUS.

; *****
; BOARD STATUS AND CONTROL PORTS
; *****

0001      BS.US0 ==      001H      ;1791-01 INDICATOR (CLOSED).
0000      BC.DR0 ==      000H      ;DRIVE 0 SELECT.
0004      BC.DSE ==      004H      ;DRIVE SELECT ENABLE

; *****
; DISK STATUS MASKS
; *****

009C      DM.RER ==      10011100B      ;READ ERROR TEST MASK
0004      DM.TK0 ==      00000100B      ;TRACK 0 TEST

; *****
; DISK DRIVE PARAMETERS
; *****

0008      TM.STP ==      8              ;STEPPER INTERVAL - MS.
0001      TM.DBR ==      1              ;DELAY BEFORE READ- MS.
0050      NB.TRK ==      80             ;MAXIMUM NMBER OF STEPS.

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; *****
; INTERNAL MEMORY ASSIGNMENTS
; *****

0000      BANK.0  ==      0000H      ; LOWER BANK ADDRESS.
0400      BANK.L  ==      0400H      ; 1K BANK LENGTH.
0400      BANK.1  ==      BANK.0+BANK.L  ; UPPER BANK ADDRESS.
0066      INT.NM  ==      BANK.0+0066H  ; NON-MASKABLE INT ADDR.
0376      BL.ERC  ==      BANK.0+0376H.  ; ERROR CODE LOCATION.
0377      BL.DCS  ==      BANK.0+0377H  ; DISK CONTROLLER STAT.

; *****
; BOOTSTRAP COMMUNICATION
; *****

0001      BE.HOM  ==      001H        ; HOME ERROR.
0002      BE.RDA  ==      002H        ; READ ERROR A.
0004      BE.RDB  ==      004H        ; READ ERROR B.

; *****
; DISK CONTROLLER MODULE (DCM) LINKAGE
; *****

000D      DCM.SS  ==      13          ; FIRST DCM SECTOR = 13.
0403      DCM.BG  ==      BANK.1+3    ; DCM COLD START ENTRY.
0400      DCM.LN  ==      0400H       ; DCM LENGTH

; *****
; ASSEMBLER DIRECTIVES
; *****

          .PABS          ; ABSOLUTE ADDRESSING.
          .PHEX          ; INTEL HEX FILE FORM.
          .XLINK          ; NO LINKAGE OUTPUT.
0000      .LOC      BANK.0      ; PROGRAM START POINT

; *****
; DELAY MACRO.  ALLOWS 1791 TO DIGEST INSTRUCTIONS
; *****

.DEFINE DELAY = [
    XTHL
    XTHL
    XTHL
    XTHL]

; *****

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;*****
; SET STACK, START DRIVE MOTOR, AND SET INVERT SW (C) *
;*****

0000 31 0400 BEGIN: LXI SP,BANK.1 ;SET UP STACK.
0003 DB40 IN XP.MTX ;TURN ON MOTOR.
0005 0E00 MVI C,0 ;ASSUME 1793.
0007 DB00 IN BL.STS ;INPUT STATUS.
0009 E601 ANI BS.USO ;TEST USER SW 0.
000B 2002 JRNZ SELECT ;GOTO SELECT DRV.
000D 0EFF MVI C,OFFH ;1791-01 INVERTS.

;*****
; CLEAR 1791-01 INTERRUPT AND SELECT DRIVE 0 *
;*****

000F CD 009C SELECT: CALL STATUS ;179X-01 FORCED CLEAR.
0012 3E04 MVI A,BC.DSE!BC.DRO ;DRIVE 0, ENABLED.
0014 D300 OUT BL.CTL ;OUTPUT CONTROLS.

;*****
; POSITION R/W HEAD AT TRACK ZERO *
;*****

0016 2E50 HOME: MVI L,NB.TRK ;SET MAX TRACKS.
0018 CD 009C STEP: CALL STATUS ;GET 179X STATUS.
001B E604 ANI DM.TKO ;TEST TRACK 0 BIT.
001D 200E JRNZ TRACK0 ;TRACK 0 EXIT.
001F 2D DCR L ;DEC ATTEMPTS.
0020 CA 0091 JZ ER.HOM ;CANT FIND TRK 0?
0023 DB08 IN XP.STP ;ISSUE STEP PULSE.
0025 11 0008 LXI D,TM.STP ;STEP INTERVAL TIME.
0028 CD 00A9 CALL TIMER ;PAUSE FOR PERIOD.
002B 18EB JMPR STEP ;TRY ANOTHER TIME.

;*****
; LOAD R/W HEAD ON SELECTED DRIVE *
;*****

002D 79 TRACK0: MOV A,C ;GET TRACK 0 VALUE.
002E D305 OUT WD.TRK ;SET TRACK REGISTER.
0030 D307 OUT WD.DTA ;SEEK SAME TRACK.
0032 FD21 003D LXI Y,RD.SET ;SET NMI RETURN ADDR.
0036 3E18 MVI A,DC.HDL ;HEAD LOAD COMMAND.
0038 A9 XRA C ;INVERT (1791-01).
0039 D304 OUT WD.CMD ;ISSUE COMMAND.
003B 18FE JMPR . ;WAIT FOR INTERRUPT.

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; *****
; SET-UP FOR DCM READ OPERATION
; *****

003D    11 0001    RD.SET: LXI    D,TM.DBR    ;DELAY BEFORE READ.
0040    CD 00A9    CALL    TIMER    ;CALL MS. TIMER.
0043    11 0400    LXI    D,BANK.L    ;SET BANK LENGTH
0046    21 0400    LXI    H,BANK.1    ;DCM LOAD ADDRESS
0049    FD21 0089    LXI    Y,ER.RDA    ;READ ERROR TRAP.
004D    3E0D    MVI    A,DCM.SS    ;FIRST SEC OF DCM.
004F    A9    XRA    C    ;INVERT (1791-01)
0050    D306    OUT    WD.SEC    ;SET 179X SEC REG.
0052    3E90    MVI    A,DC.RMS    ;READ MULTI-SECTOR.
0054    A9    XRA    C    ;INVERT (1791-01).
0055    D304    OUT    WD.CMD    ;ISSUE 179X COMMAND.
0057    E3    DELAY    ;ALLOW 179X TO SETTLE.
005B    1813    JMPR    R.BYTE    ;GOTO READ ROUTINE.

; *****
; DISK INTERRUPT "NMI" ROUTINE
; *****

0066                .LOC    INT.NM

0066    DB04    WD.INT: IN    WD.STS    ;GET 1791 STATUS.
0068    A9    XRA    C    ;INVERT (1791-01).
0069    32 0377    STA    BL.DCS    ;MAKE STATUS VISIBLE.
006C    FDE3    XTIY    ;EXCHANGE (SP)<>IY!
006E    ED45    RETN    ;BRANCH VECTOR ADDR.

; *****
; ACCEPT EACH BYTE AND STORE IN MEMORY
; *****

0070    DB80    R.BYTE: IN    XP.DSH    ;WAIT FOR DATA.
0072    DB07    IN    WD.DTA    ;INPUT INV DATA.
0074    A9    XRA    C    ;INVERT (1791-01).
0075    77    MOV    M,A    ;STORE DCM BYTE.
0076    23    INX    H    ;INCREMENT POINTER.
0077    1B    DCX    D    ;DECREMENT LENGTH.
0078    7A    MOV    A,D    ;GET HIGH REG.
0079    B3    ORA    E    ;THEN OR-IN LOW REG.
007A    20F4    JRNZ    R.BYTE    ;READ ANOTHER BYTE.

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;*****
; TEST READ STATUS, TERMINATE OPERATION, GO DCM
;*****

007C DB04 R.TEST: IN WD.STS ;INPUT READ STATUS.
007E A9 XRA C ;INVERT (1791-01).
007F E69C ANI DM.RER ;TEST FOR ERRORS.
0081 200A JRNZ ER.RDB ;READ ERROR TRAP.
0083 CD 009C CALL STATUS ;TERMINATE READ.
0086 C3 0403 JMP DCM.BG ;TRANSFER TO DCM.

;*****
; READ ERROR HAS BEEN DETECTED
;*****

0089 3E02 ER.RDA: MVI A,BE.RDA ;LOAD READ ERROR CODE.
008B 1806 JMPR ER.HLT ;GO TO ERROR HALT.
008D 3E04 ER.RDB: MVI A,BE.RDB ;LOAD READ ERROR CODE.
008F 1802 JMPR ER.HLT ;GO TO ERROR HALT.
0091 3E01 ER.HOM: MVI A,BE.HOM ;HOME ERROR CODE.
0093 32 0376 ER.HLT: STA BL.ERC ;DISPLAY ERROR CODE.
0096 AF XRA A ;ZERO A REG.
0097 D300 OUT BL.STS ;DESELECT DRIVE.
0099 DB10 IN XP.MTO ;MOTOR OFF!
009B 76 HLT ;TERMINATE.

;*****
; GET UPDATED 1791-01 STATUS
;*****

009C 3ED0 STATUS: MVI A,DC.STS ;TYPE 4 - STATUS.
009E A9 XRA C ;INVERT (1791-01).
009F D304 OUT WD.CMD ;ISSUE COMMAND.
00A1 E3 DELAY ;ALLOW 1791 TIME.
00A5 DB04 IN WD.STS ;GET STATUS
00A7 A9 XRA C ;INVERT (1791-01).
00A8 C9 RET ;RETURN TO CALLER.

;*****
; TIMER - WAIT FOR (BC * 1.0) MILLISECONDS
;*****

00A9 3EF7 TIMER: MVI A,247 ;LOAD INT MS VALUE.
00AB 3D MS.INT: DCR A ;DEC FOR 1 MS.
00AC 20FD JRNZ MS.INT ;REPEAT FOR 1 MS.
00AE 1B DCX D ;TEST FOR ANOTHER MS.
00AF 7A MOV A,D ;CHECK REG D.
00B0 B3 ORA E ;AND REGISTER E.
00B1 20F6 JRNZ TIMER ;DO ANOTHER 1 MS.
00B3 C9 RET ;TIME PERIOD EXPIRED!

;*****

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.END

TDL Z80 CP/M DISK ASSEMBLER VERSION 2.21
INJECTION MODULE - JADE DOUBLE D DISK CONTROLLER
+++++ SYMBOL TABLE +++++

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| | | | |
|-------------|-------------|-------------|-------------|
| BANK.0 0000 | BANK.1 0400 | BANK.L 0400 | BC.DRO 0000 |
| BC.DSE 0004 | BEGIN 0000 | BE.HOM 0001 | BE.RDA 0002 |
| BE.RDB 0004 | BL.CTL 0000 | BL.DCS 0377 | BL.ERC 0376 |
| BL.STS 0000 | BS.USO 0001 | DCM.BG 0403 | DCM.LN 0400 |
| DCM.SS 000D | DC.HDL 0018 | DC.RMS 0090 | DC.STS 00D0 |
| DM.RER 009C | DM.TKO 0004 | ER.HLT 0093 | ER.HOM 0091 |
| ER.RDA 0089 | ER.RDB 008D | HOM 0016 | INT.NM 0066 |
| MS.INT 00AB | NB.TRK 0050 | RD.SET 003D | R.BYTE 0070 |
| R.TEST 007C | SELECT 000F | STATUS 009C | STEP 0018 |
| TIMER 00A9 | TM.DBR 0001 | TM.STP 0008 | TRACK0 002D |
| WD.CMD 00C4 | WD.DTA 0007 | WD.INT 0066 | WD.SEC 0006 |
| WD.STS 00C4 | WD.TRK 0005 | XP.DSH 0080 | XP.MTD 0010 |
| XP.MTX 0040 | XP.STP 0008 | | |

